IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF OKLAHOMA

STATE OF OKLAHOMA, ex rel. W.A. DREW EDMONDSON, in his capacity as ATTORNEY GENERAL OF THE STATE OF OKLAHOMA and OKLAHOMA SECRETARY OF THE ENVIRONMENT C. MILES TOLBERT, in his capacity as the TRUSTEE FOR NATURAL RESOURCES FOR THE STATE OF OKLAHOMA Plaintiff, vs. TYSON FOODS, TYSON POULTRY, INC., TYSON CHICKEN, INC., COBB-VANTRESS, INC., AVIAGEN, INC., CAL-MAINE FOODS, INC., CAL-MAINE FARMS, INC., CARGILL, INC., CARGILL TURKEY PRODUCTS, LLC, GEORGES'S, INC., GEORGE'S FARMS, INC., PETERSON FARMS, INC., SIMMONS FOODS, INC., AND WILLOWBROOD FOODS, INC. Defendants.	Case No. 4:05-cv-00329-GKF-SAJ

AFFIDAVIT OF DR. CHRISTOPHER M. TEAF

The undersigned, Christopher M. Teaf, does solemnly swear and state:

1. My name is Dr. Christopher M. Teaf. I received a Bachelor's degree in Biology (with Honors) from Pennsylvania State University and a Master's degree in Biological Science from Florida State University. I earned my Ph.D. in Toxicology from the University of Arkansas for Medical Sciences (Little Rock, Arkansas) and conducted my research at the Division of Genetic Toxicology, National Center for Toxicological Research (Jefferson, Arkansas).

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2. I presently hold positions as Associate Director at the Center for Biomedical & Toxicological Research and Waste Management at Florida State University (since 1983), as well as Director of Toxicology for the research firm of Hazardous Substance & Waste Management Research, Inc. since 1985 (President since 1989). I have held adjunct teaching appointments at the Florida State University/State University System Program in Medical Sciences and the Florida A & M University College of Pharmacy and Pharmaceutical Sciences.

3. My research and scientific advisory activities principally are in the area of risk assessment for human exposure to occupational and/or environmental chemical and biological hazards. My principal activities for approximately 25 years have included the performance of risk assessments concerning human health and the evaluation of adverse effects of chemical and biological exposures under the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, Superfund), Superfund Amendments and Reauthorization Act (SARA), the Resource Conservation and Recovery Act (RCRA), the Toxic Substances Control Act (TSCA), the Occupational Safety and Health Act (OSHA), and other related federal or state legislation. My activities have involved evaluation of potential human health impacts of many organic substances (e.g., petroleum products, pesticides, chlorinated and non-chlorinated solvents), inorganic agents (e.g., acids/caustics, metals, particulates, fibers) and microbiota (e.g., bacteria, molds, fungi) in air, water, soils and sediments.

4. I have served as a peer reviewer for publications submitted to numerous scientific journals and presently serve on the Editorial Boards for several of these scientific journals. I am Senior Human Health Editor for the international journal *Human & Ecological Risk Assessment*. I have published many scientific papers, articles and book chapters concerning toxicological effects and risk evaluations related to occupational and environmental exposures and effects.

5. For over 25 years, I have directed and conducted research projects and human health education activities for many agencies such as the World Health Organization (WHO), the North Atlantic Treaty Organization (NATO), the U.S. Environmental

Protection Agency (U.S. EPA), the U.S. Department of Energy (U.S. DOE), the U.S. Department of Agriculture (U.S. DOA), the federal Agency for Toxic Substances and Disease Registry (ATSDR), the Florida Department of Environmental Protection (FDEP), the Florida Department of Health (FDOH), the Florida Department of Community Affairs, and many local governmental entities. These activities have been conducted in the United States, as well as Eastern Europe (e.g., Bulgaria, Czech Republic, Hungary, Poland), in Central Asia (e.g., Kazakhstan), and in Russia.

6. I have provided advisory services on toxicology, risk assessment, and environmental health issues to the U.S. Department of Justice, Florida State Attorney's Office, and Attorneys General for Florida, Washington, and Oklahoma. I have been qualified to provide expert testimony to federal and state courts, to administrative proceedings, and to regulatory or legislative groups concerning toxicology, environmental chemistry, occupational exposure, health effects of chemicals, and risk assessment since 1986.

7. I have been retained in this case by the Oklahoma Office of the Attorney General to provide technical analysis and opinions in the areas of toxicology and human health for issues associated with the land application of poultry waste within the Illinois River Watershed (IRW).

8. I have reviewed a number of documents, including but not limited to documents prepared by the U.S. EPA and documents prepared by several State Agencies including the Oklahoma Water Resources Board (OWRB),the Oklahoma Conservation Commission (OCC), and the Oklahoma Department of Environmental Quality (ODEQ). In addition, I have reviewed numerous peer-reviewed scientific articles relating to the topics addressed in this Affidavit. Finally, I have reviewed analytical results for numerous samples of soils, sediments, surface water and groundwater which were collected in the IRW.

9. There are demonstrated historical and ongoing hazards and impairments in the Illinois River Watershed for bacteria and impacts related to land spreading of poultry waste. The Illinois River and most of it's tributaries, including the Baron Fork Creek

and Flint Creek, have been classified by the State of Oklahoma as Outstanding Resource Waters (ORW) for purposes of recreation, wildlife propagation and aesthetic values. The ongoing hazards and impairments present in these water bodies limit the safe human activities that are associated with the designated uses of these water resources.

10. The following discussion provides information that illustrates why the observed hazards and impairments can be and are harmful to human health, and how those hazards and impairments are linked to the practice of spreading poultry manure and/or litter on fields.

11. There are currently 8 water bodies within the Oklahoma portion of the IRW listed on the 2006 U.S. EPA 303(d) list that are categorized as "impaired" for Primary Body Contact Recreation (PBCR) as a result of pathogens and indicator bacteria (including *E. coli*, enterococci, and/or fecal coliforms). The U.S. EPA "303d List" was developed as part of the 1972 amendments to the Clean Water Act and requires states to compile lists of water bodies that are "impaired" for various parameters, and to submit updated lists of the impaired water bodies to the U.S. EPA every two years. The U.S. EPA 303d list defines "impaired" as not meeting the water quality standards. The presence and magnitude of such indicator bacteria is a commonly used and widely accepted measure of the potential for presence and significance of other pathogens, including other bacteria, viruses and protozoa.

12. Bacteria have been detected in surface water, groundwater and sediments in the IRW at levels that are hazardous from a human health perspective. Edge-of-field samples for agricultural fields that have received spreading of poultry manure and litter can show bacterial counts in water which are similar to those reported for raw, untreated sewage. Recently, over six consecutive years (2000-2005), there has been widespread measurement of the presence of indicator organisms in surface waters of the IRW which indicate that those waters exceed the Oklahoma Water Quality Standards and/or health-based screening levels. These exceedances have been documented in at least 18 different locations throughout the IRW. The standards for bacteria in groundwater are set at zero. Therefore, any detected value is in violation of

the standard. There have been numerous violations of the groundwater contamination standard concerning bacteria throughout the IRW as shown in 2006 and 2007 groundwater sampling.

13. Primary Body Contact Recreation (PBCR) is an exposure category defined as involving direct body contact with surface water (i.e., dermal exposure route) where the additional possibility of incidental water ingestion (i.e., oral exposure route) also exists. In water bodies that are governed by the PBCR requirements, the State of Oklahoma mandates that such water "shall not contain chemical, physical or biological substances in concentrations that are irritating to skin or sense organs or are toxic or cause illness upon ingestion by human beings". Clearly, levels of bacterial indicator organisms that exceed health-based criteria and other standards pose such a risk.

14. Information available regarding land disposal of poultry manure and litter shows that nearly two-thirds (over 63%) of that land spreading occurs in the months of February through June, based upon data for the period 1999-2004. Information available regarding the pattern of a major PBCR use ("floating") within the Illinois River and its tributaries in the 2004-2007 period by month shows that 99% of that usage type occurs in the months of May through September. Floating includes ancillary direct contact activities such as swimming and wading as well. Thus, a very large proportion of total annual land spreading of poultry waste is conducted during months which just precede or are coincident with times of maximum direct contact recreational use of the Illinois River.

15. In addition to primary body contact associated with surface water exposures, significant exposures to contaminated groundwater can occur through drinking water supplies as well. In Oklahoma, groundwater is protected such that bacterial levels in groundwater must be "nondetect". Once pollution has been determined to have occurred via human activities, the water supply is to be restored to a quality sufficient to support its designated beneficial use. Over 1,700 groundwater wells have been identified in the Oklahoma portion of the IRW, of which 98% are used for domestic purposes. Bacterial contamination of groundwater, including by *E. coli*, total coliforms,

fecal coliforms, enterococci has been demonstrated in many shallow wells and in other wells at depths to approximately 150 feet, as well as in a majority of shallow groundwater Geoprobe samples. This demonstrates the vulnerability of shallow groundwater, and illustrates the health concern associated with land spreading of poultry manure/litter in areas where groundwater is used for potable and other domestic purposes. In addition, bacterial levels of human health significance have been found in a number of springs within the IRW. At their point of release from the ground, where they "daylight", springs represent a transition from groundwater to surface water. Thus, they can be indicators of impacts to groundwater and/or surface water.

16. Published, peer reviewed papers have long recognized that land spreading of poultry litter and manure is a major bacterial contamination source. Rainfall, specifically shortly after land spreading of poultry waste, may result in bacterial pathogen spread by runoff from stored or unincorporated manure, or by leaching into groundwater through the soil profile. Runoff from fields that have received manure/litter application carries excess nutrients, pollutants, and pathogens to nearby waterways, which subsequently can negatively affect surface water quality, groundwater quality, aquatic life, and human health.

17. Bacteria of human health significance, including *Escherichia coli* (*E. coli*) and other species, as well as bacterial indicator organisms such as fecal coliforms and enterococci, are present in poultry waste. The presence of these bacterial indicator organisms in surface and groundwater bodies suggests that other dangerous bacteria such as *Campylobacter*, *Salmonella* and/or *Staphylococcus* also may be present, in addition to viruses and protozoa that are more difficult to monitor. Statistical measures of common presence for a variety of analytes (e.g., Principal Component Analysis or PCA) have been addressed by Dr. Roger Olsen. These measures support a conclusion that the bacterial impacts are related to, and occur with, land application of poultry manure/litter.

18. *Campylobacter* is a common intestinal bacterium or microbe found in a wide range of poultry, domestic livestock, and wildlife. *Salmonella* is also a bacterium frequently associated with poultry and numerous *Staphylococcus* species have been isolated from chickens, including *S. aureus, S. sciuri, S. gallinarum, S. lentus, S. chnii, S. xylosus,* and *S. warneri.* Infectious diseases related to fecal bacteria from poultry manure and litter include campylobacteriosis, giardiasis, cryptosporidiosis, salmonellosis, *E. coli* 0157:H7, and others. Gastroenteritis, caused by fecal pathogens and characterized by nausea, cramps, diarrhea, and vomiting, is a common and serious affliction associated with waterborne bacteria. The major effects and complications of *Campylobacter* infection (e.g., cholecystitis, pancreatitis, peritonitis, and massive gastrointestinal hemorrhage) can occur in or near the gastrointestinal tract. *Enterococcus* can cause serious human infection including infections of the urinary tract, blood, respiratory tract or central nervous system (CNS). Important infections caused by *Staphylococcus,* including recent widely publicized antibiotic resistant strains, typically involve the skin, as evidenced by boils, cellulitis, and serious wound infections. Many other organ systems in the human body can be affected as well.

19. The Oklahoma State Department of Health (OSDH) maintains statistics of specific reportable diseases including diseases caused by bacteria such as Campylobacter, Salmonella, and E. coli 0157:H7 as well as microscopic parasites such as *Giardia* and *Cryptosporidium.* These organisms have been associated with poultry waste and often are also associated with contaminated drinking water, fecal material, raw sewage, and contact with birds. An evaluation of OSDH records for Oklahoma counties in the IRW shows that Adair County reported rates of campylobacteriosis considerably in excess of the state average for the period 1997 to 2005. Adair County makes up the largest portion of Oklahoma land area within the IRW. In addition, rates of salmonellosis in that county reported between 1990-2005 also have periodically exceeded the average statewide incidence rate. The rate of salmonellosis in Sequoyah County was reported to exceed the State rate for all except three years during the period 1990 to 2001. These preliminary observations concerning disease occurrence in

northeastern Oklahoma underscore the potential for increases in infectious diseases related to land disposal of poultry waste in large quantities.

20. The foregoing information and analyses show that the disposal of poultry waste by land application in the IRW represents a present, substantial, and serious threat to human health. There are biological hazards and impairments from bacteria associated with land spreading of poultry manure and litter within the IRW which are present at levels that are capable of causing damage to human health and which will continue to pose such risks until action is taken to eliminate the principal sources of these hazards and impairments.

Christopher M. Teaf

CHRISTOPHER M. TEAF, Ph.D.

STATE OF FLORIDA
COUNTY OF LEON

Subscribed and sworn to me by Christopher M. Teaf, Ph.D., on the 12th day of November, 2007.

Sharon M. Haughton

Signature

Sharon M. Haughton
Commission # DD406267
Expires June 25, 2009
Bonded Troy Fain - Insurance, Inc. 800-385-7019

Printed Name

Notary Public, State of Florida, County of Leon

My Commission Expires: _____